

REMARKS

Favorable reconsideration is respectfully requested in light of the following remarks, wherein Claims 1, 16, 19, 30 and 31 have been amended. Currently, Claims 1-32 are pending in the present application.

As an initial matter, the Abstract stands object to for including the legal phraseology “means”. Accordingly, Applicants have amended the Abstract to remove this term. Accordingly, withdrawal of the objection to the Abstract is respectfully requested.

Claims 1-32 stand rejected under 35 U.S.C. §112, second paragraph, as being indefinite. As a result, Applicants have amended Claims 1, 16, 19, 30, and 31 to remove these informalities. With regard to the alleged lack of antecedent basis with respect to Claims 4 and 5, Applicants respectfully submit that Claims 4 and 5 do not include the term “pressure plate”. With regard to the allegation that “or” renders certain claims indefinite, Applicants respectfully disagree. MPEP 2173.05(h)(II) states that alternative limitations such as “or” are acceptable. Accordingly, withdrawal of the rejections based upon 35 U.S.C. §112, second paragraph, is respectfully requested.

Claims 1-32 stand rejected under 35 U.S.C. §102(b) as being anticipated by or in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,029,753 to *Kuusento et al.* or U.S. Patent No. 6,186,246 to *Muuttonen*.

The present invention pertains to a method and apparatus for generating a stress pulse in a tool. As defined in independent Claims 1 and 16, pressure fluid is fed to a working chamber of an impact device between a frame of the impact device and the tool such that the pressure of the pressure fluid produces a force between the frame of the impact device and the tool. The force

presses the tool towards the material to be processed such that due to the influence of the force, a stress pulse is generated in the tool in its longitudinal direction such that the stress pulse propagates through the tool to the material to be processed. The generation of the stress pulse ends substantially at the same time as the influence of the force on the tool ends.

As described in the Background of the Invention, a problem with the prior art impact devices is that the reciprocating movement of the percussion piston produces dynamic accelerating forces that complicate control of the apparatus. As the percussion piston accelerates in the direction of impact, the frame of an impact device tends to simultaneously move in the opposite direction, thus reducing the compressive force of the end of the drill bit or the tool with respect to the material like, for instance, rock to be processed. In order to maintain a sufficiently high compressive force of the drill bit or the tool against the material to be processed, the impact device must be pushed sufficiently strongly towards the material. This, in turn, requires the additional force to be taken into account in the supporting and other structures of the impact device, wherefore the apparatus will become larger and heavier and more expensive to manufacture. Due to its mass, the percussion piston is slow, which restricts the reciprocating frequency of the percussion piston and thus the striking frequency, although it should be significantly increased in order to improve the efficiency of the impact device.

The present invention solves this problem by generating a stress pulse by means of a pressure pulse compressing the tool and acting between the impact device and the tool, so that as a result of the tool being compressed, a stress pulse is generated substantially simultaneously with and similar in length to the pressure pulse. An advantage of the invention is that the impulse-like impact movement thus generated does not necessitate a reciprocating percussion

piston which generates a stress pulse by means of its kinetic energy. Consequently, as a result of the invention, no large masses are moved back and forth and the dynamic forces are small as compared with the dynamic forces of the reciprocating, heavy percussion pistons of the known solutions. A further advantage of the invention is that it is simple, and thus easy, to implement. Yet another advantage of the invention is that the operation of the impact device is easy to adjust in order to achieve impact performance as desired. None of the art of record disclose the patentable features of independent Claims 1 and 16.

Kuusento et al. pertains to a percussion piston for use in a drilling apparatus, which includes a drill bit and at least three tubular parts which increase in diameter in a direction extending from the drill bit toward a rear end of the piston. The piston further includes flanges positioned between the tubular parts and a first corresponding delivery space at the rear end of the piston. At least two additional corresponding delivery spaces are positioned between the first corresponding delivery space and the drill bit. Channels allow the transport of pressurized hydraulic fluid to and from the first and additional corresponding delivery spaces such that an energy pulse produced by impact of the piston on the drill bit is almost completely absorbed by the drilled object.

However, the above-noted apparatus of *Kuusento et al.* uses pressure fluid to accelerate a piston in the direction of the tool. *Kuusento et al.* does not disclose that the pressure fluid is fed to a working chamber of an impact device between a frame of the impact device and the tool such that the pressure of the pressure fluid produces a force between the frame of the impact device and the tool. In *Kuusento et al.*, the force generated is not between the frame of the impact device and the tool. Moreover, the piston in *Kuusento et al.* does not generate a stress

pulse in the tool in its longitudinal direction such that the stress pulse propagates through the tool to the material to be processed where the generation of the stress pulse ends substantially at the same time as the influence of the force on the tool ends. In addition, the Examiner has failed to present evidence as to why one having ordinary skill in the art would not modify *Kuusento et al.* to obtain the features of independent Claims 1 and 16. Accordingly, *Kuusento et al.* fails to disclose or suggest the patentable features of independent Claims 1 and 16.

Likewise, *Muuttonen et al.* fails to disclose the patentable features of independent Claims 1 and 16. In particular, *Muuttonen et al.* discloses a method for adjusting percussion pressure and a drilling machine. In the method the percussion power of a drilling machine is adjusted by moving a shank in the longitudinal direction of the drilling machine forwards when a smaller percussion power is to be transferred from the percussion piston to the shank. The drilling machine comprises at least two groups of pistons moving in the axial direction of the drilling machine, the pistons being connected to act on the shank by means of a pressure medium acting behind the pistons towards the front end of the drilling machine. The drilling machine comprises at least two separate groups of pistons whose travel with respect to one another is different and where pressure medium channels separate from one another lead to the cylinder spaces of both piston groups.

However, *Muuttonen et al.* fails to disclose the feature that the pressure fluid is fed to a working chamber of an impact device between a frame of the impact device and the tool such that the pressure of the pressure fluid produces a force between the frame of the impact device and the tool. In contrast, the pistons 4a, 4b in *Muuttonen et al.* produce a rearward force towards the rotating shank 2 and not the tool 1. In addition, the principles surrounding *Muuttonen et al.*

are completely different than the principles surrounding the present invention. In particular, *Muuttonen et al.* addresses adjusting the position of the shank with respect to the optimal percussion point and the force on the shank when it deviates from its optimal percussion point. When rock contact of a drill bit is to be adjusted, the pressure acting behind the pistons is kept such that a smaller pressure than a feed force is behind the pistons which are capable of moving forwards from their optimal percussion point, the pressure being variable according to the number of drill rods used in long hole drilling in such a manner that at the arrival of a percussion pulse, the drill bit can always be kept as desired in contact with the rock to be drilled without any essential power loss to the absorber. Accordingly, *Muuttonen et al.* fails to disclose the patentable features of independent Claims 1 and 16.

Further and with respect to differences between the present claims and disclosure in *Kuusento et al.* and *Muuttonen et al.*, Applicants note the following. The cited prior art each have a piston moved by hydraulic pressure in a reciprocating motion – forward to strike the shank of a tool and then backwards to complete the stroke. The claimed method and pressure fluid impact device, rock drill or braker does not operate by such a stroke. Rather, the tool 3 is positioned in contact with the transmission piece 8 and changes in pressurization of fluid/gas in work chamber 7 creates a pressure pulse that is transmitted toward the tool 3 and propagates therethrough. The pressurization is then released followed by a repressurization to create a second and subsequent pressure pulses. (see para. [0021] of published application). Accordingly, it is respectfully asserted that the presently claimed method and pressure fluid impact device, rock drill or braker operate by a very different principle than the reciprocating stroke disclosed in the prior art.

For at least the foregoing reasons, it is submitted that independent Claims 1 and 16, and the claims depending therefrom, are patentably distinguishable over the applied documents. Accordingly, withdrawal of the rejections of record and allowance of this application are earnestly solicited.

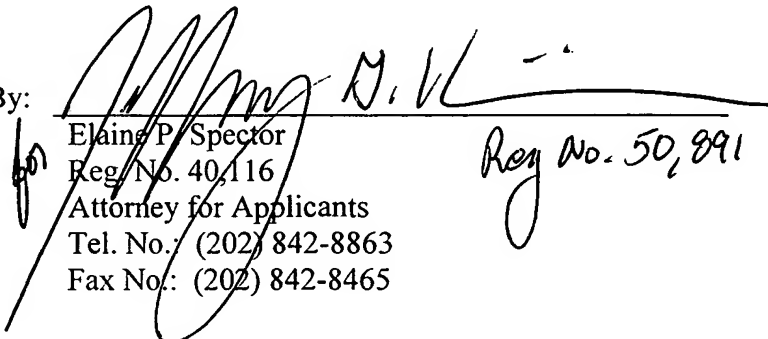
Should any questions arise in connection with this application, or should the Examiner believe a telephone conference would be helpful in resolving any remaining issues pertaining to this application, it is respectfully requested that the undersigned be contacted at the number indicated below.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account 50-0573. This paragraph is intended to be a CONSTRUCTIVE PETITION FOR EXTENSION OF TIME in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully Submitted,

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